

WHAT IS CLAIMED IS:

Sub A 9
1. An apparatus for forming a thermoplastic resin foam comprising:

a screw cylinder having a material supply hole arranged near a rear end portion of one end of the screw cylinder and an injection nozzle arranged on a top end portion of the other end of the screw cylinder;

a screw, provided in said screw cylinder, rotatably driven in directions of plasticization and injection, said screw corresponding to said screw cylinder and classified as a first metalization portion, a low-pressure portion, and second metalization portion in that order from the rear end portion to the top end portion;

a gas supply hole for injecting an inert gas, such as a carbon dioxide gas or a nitrogen gas having, at least in pressure, a pressure equal to or greater than a supercritical pressure or for injecting an inert gas under a supercritical state, said gas supply hole being disposed at a position corresponding to the low-pressure portion of said screw of said screw cylinder; and

drive means for driving said screw in the directions of plasticization and injection.

2. An apparatus for forming a thermoplastic resin foam as claimed in claim 1, wherein said drive means comprise an

3 electric servomotor.

1 3. A method for forming a thermoplastic resin foam comprising
2 the steps of:

3 plasticizing a thermoplastic resin material by rotatably
4 driving a screw provided drivably in directions of
5 plasticization and injection inside a screw cylinder,

6 injecting melted resin, permeated by an inert gas, into
7 a mold by driving said screw in the direction of injection after
8 having injected the inert gas such as a carbon dioxide or a
9 nitrogen gas having, at least in pressure, a pressure equal to
10 or greater than a supercritical pressure or the inert gas under
11 a supercritical state into said screw cylinder to allow the
12 inert gas to permeate melted resin,

13 wherein an electric servomotor is used as a drive means
14 for driving said screw in the directions of plasticization and
15 injection,

1 4. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein after the step of plasticizing the
3 thermoplastic resin material has been completed, said screw is
4 prevented from retreating by applying brake to said electric
5 servomotor to maintain a pressure at a supercritical pressure
6 or more inside said screw cylinder.

1 5. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein the step of plasticizing the thermoplastic
3 resin material is performed until immediately before the step
4 of injecting the melted resin is initiated.

6. A method for forming a thermoplastic resin foam as claimed in claim 3, wherein even after the step of plasticizing the thermoplastic resin material has been completed, said screw is driven at low speeds in the direction of plasticization until immediately before the step of injecting the melted resin is initiated.

7. A method for forming a thermoplastic resin foam as claimed in claim 3, wherein when a pressure has dropped below a pre-set value inside said screw cylinder, said screw is driven in the direction of plasticization so as to stop said screw when the pressure becomes equal to or greater than the pre-set value in order to maintain the pressure at a supercritical pressure or more inside said screw cylinder.

1 8. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein when said screw is driven in the direction
3 of plasticization, driving said screw in the opposite direction
4 of plasticization is intermittently combined therewith.

1 9. A method for forming a thermoplastic resin foam as claimed
2 in claim 3, wherein during plasticization, said screw cylinder
3 is provided with micro-vibration in the direction of injection.

1 10. A method for forming a thermoplastic resin foam according
2 to claim 3, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

an inert gas having, at least in pressure, a pressure equal to or greater than a supercritical pressure or an inert gas under a supercritical state is injected into a position corresponding to the low-pressure portion of said screw of said screw cylinder.

1 11. A method for forming a thermoplastic resin foam according
2 to claim 4, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding

10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 12. A method for forming a thermoplastic resin foam according
2 to claim 5, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 13. A method for forming a thermoplastic resin foam according
2 to claim 6, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw

11 cylinder.

1 14. A method for forming a thermoplastic resin foam according
2 to claim 7, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 15. A method for forming a thermoplastic resin foam according
2 to claim 8, wherein said screw corresponds to said screw
3 cylinder and is selected as a first metalization portion, a
4 low-pressure portion, and second metalization portion in that
5 order from a rear end portion to a top end portion of said screw;
6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
8 to or greater than a supercritical pressure or an inert gas under
9 a supercritical state is injected into a position corresponding
10 to the low-pressure portion of said screw of said screw
11 cylinder.

1 16. A method for forming a thermoplastic resin foam according
 2 to claim 9, wherein said screw corresponds to said screw
 3 cylinder and is selected as a first metalization portion, a
 4 low-pressure portion, and second metalization portion in that
 5 order from a rear end portion to a top end portion of said screw;
 6 and further comprising:

7 an inert gas having, at least in pressure, a pressure equal
 8 to or greater than a supercritical pressure or an inert gas under
 9 a supercritical state is injected into a position corresponding
 10 to the low-pressure portion of said screw of said screw
 11 cylinder.